INSTRUCTION BOOK

MEGA-PIX SENIOR

KAY ELECTRIC COMPANY

14 MAPLE AVENUE, PINE BROOK, NEW JERSEY

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INSTRUCTION BOOK

MEGA-PIX SENIOR

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KAY ELECTRIC COMPANY

14 MAPLE AVENUE, PINE BROOK, NEW JERSEY

INSTRUCTION BOOK KA 2556

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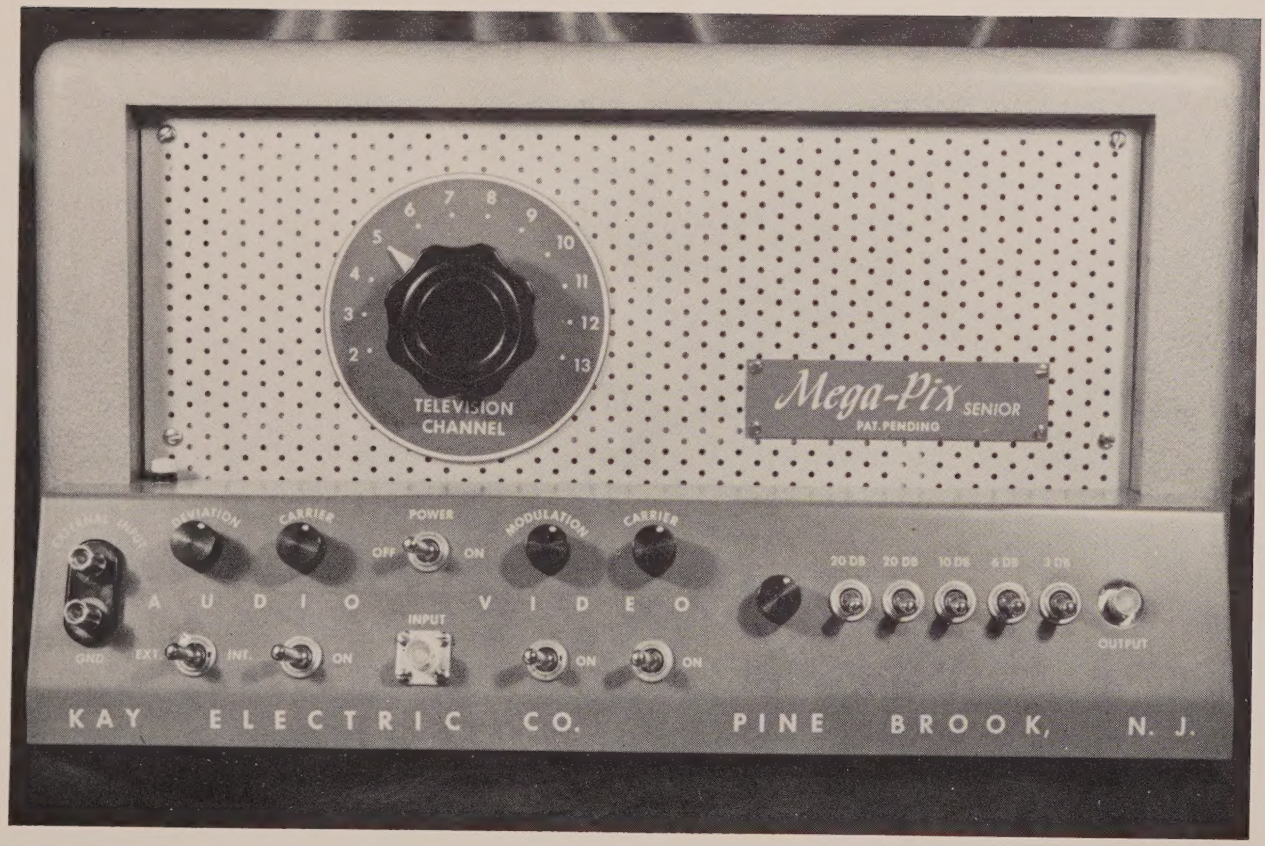


Figure 1. Mega-Pix Sr.

SECTION I

GENERAL DESCRIPTION

1. APPLICATION.

The Mega-Pix Sr. is a multi-channel signal generator designed for VHF television receiver testing and alignment, or any other application requiring a locally generated television signal. The unit is especially useful for development and production testing of color television receivers.

2. DESCRIPTION.

The Mega Pix Sr. is a twelve channel crystal-controlled r-f signal generator designed to provide a pair of fixed frequency signals on each of the twelve VHF television channels. A separate and independent crystal-controlled frequency generating circuit is employed for producing the picture frequency signal, and another is employed for the sound frequency signal, thereby assuring complete isolation of the two carriers.

Channel selection is accomplished by a centrally located channel selector; both picture and sound frequencies are selected simultaneously. Provision is included in the Mega-Pix Sr. for the connection of an external video signal source for amplitude modulation of the picture carrier. Frequency modulation of the sound carrier may be obtained either by an internal oscillator or by an external audio signal.

The Mega-Pix Sr. is constructed on a conventional chassis and panel arrangement with all operating controls and connectors, except the channel selector mounted on a sloping lower sub-panel. The unit, together with its regulated power supply, is completely enclosed in a metal cabinet. To insure isolation of the individual frequency generating sections, complete shielding is provided; these shields are readily removable for repairs and adjustments.

For special applications, front panel controls permit a variety of operating conditions; among these are: individual on-off control of either carrier, carrier level control, and separate control of video and sound modulation levels.

3. SPECIFICATIONS.

Output Signal Frequencies.. Television RF Picture and Sound Frequencies, Channels 2 to 13.

Accuracy of Picture and Sound Carriers... $\pm$ 0.01%.

Maximum Picture and Sound Carrier Output... At least 30,000 microvolts into 72 ohms.

Amplitude Control Range... Output level control for Sound Carrier plus simultaneous control range of 20 db, 20 db, 10 db, 6 db and 3 db switched, 10 db variable.

RF Output Impedance... 72 ohms.

Video Input Impedance... 72 ohms.

Video Input Signal Required... Approx. 1.4 volt, peak to peak, black negative.

Video Bandwidth... ± 1 db up to 5 mc.

Sound Carrier Deviation... Continuously variable from 0 to ± 25 kc.

Sound Modulating Frequency... 400 cps., or by external audio. Standard pre-emphasis provided.

Picture Carrier Modulation Percentage... Adjustable, 0 to over 90%.

DC Restoration... On video Modulation, may be disabled for special applications.

4. STANDARD COMPONENTS SUPPLIED.

1. Mega-Pix Sr. complete with tubes and crystals.

2. Regulated Power Supply.

3. Cabinet.

4. Instruction Book.

5. ADDITIONAL EQUIPMENT REQUIRED.

1. Video input signal source (Monoscope camera chain, or TV receiver tuned to a TV station.)

2. Cathode follower amplifier. (Required when using a TV receiver as a video signal source.) See Figure 3.

3. Connecting cables (RG-59/U), resistors and capacitors as shown in Figures 2, 3, and 4.

4. Mega-Sweep (manufactured by Kay Electric Company) for visual alignment and band-width tests.

5. Oscilloscope for visual alignment and band-width tests.

SECTION II

INSTALLATION

1. GENERAL

The Mega-Pix Sr. is designed for table-top operation. No special installation problems should be encountered. However, as a guide, the following should aid in selecting a permanent operating location for the unit:

1. Select a location where the equipment will not be subjected to excessive heat, moisture, or mechanical disturbance.

2. Ventilation louvers are provided at the sides and rear of the cabinet. Be sure that adequate space is allowed around the cabinet for air circulation.

3. The unit requires connections to a 117V, 60 cycles, power source; to a video signal source; to a sound signal source; and to the TV receiver under test. For special applications, the Mega-Pix Sr. may be connected to an oscilloscope and a Mega-Sweep unit. Cabling to the receiver under test and associated equipment should be as short as possible, using RG-59/U type cable.

2. INTERCONNECTING DATA.

2-1. R-F OUTPUT CONNECTIONS TO RECEIVER UNDER TEST.

a. If the TV receiver under test has a 72 ohm input, connect the Mega-Pix Sr. directly to the receiver input using RG-59/U cable. The Mega-Pix Sr. accepts a BNC type connector. (Unless otherwise specified.)

b. If the receiver under test has a 300 ohm input circuit, connect the Mega-Pix Sr. output signal through the impedance matching network shown in Figure 2.

2-2. VIDEO SIGNAL INPUT CONNECTIONS.

a. When using a monoscope or TV camera chain to supply a video signal for modulation of the Mega-Pix Sr. carrier, connect directly to the BNC type connector provided. The video signal supplied should be 1.4 volts peak-to-peak into 72 ohms black negative.

b. To supply a video signal from a TV receiver tuned to a TV station, connect the equipment through the cathode follower circuit shown in Figure 3. Connect the cathode follower input circuit to the output of the last video amplifier stage of the TV receiver supplying the modulation signal. The cathode follower output should be connected as shown in Figure 3, using RG-59/U cable.

2-3. AUDIO SIGNAL INPUT CONNECTIONS. When external audio modulation of the sound carrier is desired, connect an audio signal to the terminals provided. This signal may be the audio output of the TV receiver used to supply the video signal or from any other audio source. The audio input circuit is high impedance, unbalanced. A minimum audio signal of 2 volts rms is required for $\pm$ 25 kc deviation of the sound carrier.

2-4. CONNECTING MEGA-PIX SR. FOR VISUAL ALIGNMENT. To display the response characteristics of a TV receiver on an oscilloscope, connect the equipment

as shown in Figure 4. In this application, the Mega-Pix Sr. is employed as a precision frequency marker generator in conjunction with a Kay Electric Co. Mega-Sweep and an oscilloscope. No modulation should be used on the Mega-Pix Sr. carriers. The vertical deflection input of the oscilloscope should be connected directly to the TV receiver's picture signal detector circuit.

Instructions for use of the Mega-Sweep will be found in the Mega-Sweep instruction book.

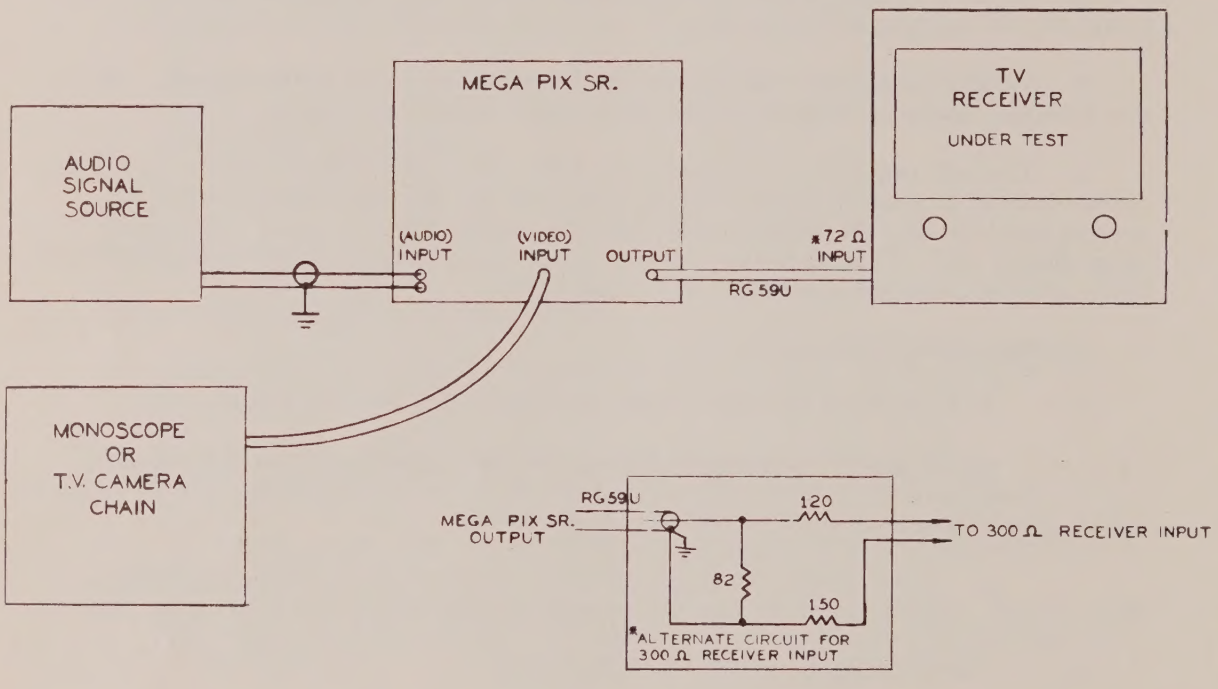


Figure 2. Mega-Pix Sr. Modulation Connections Using Monoscope (or camera chain)

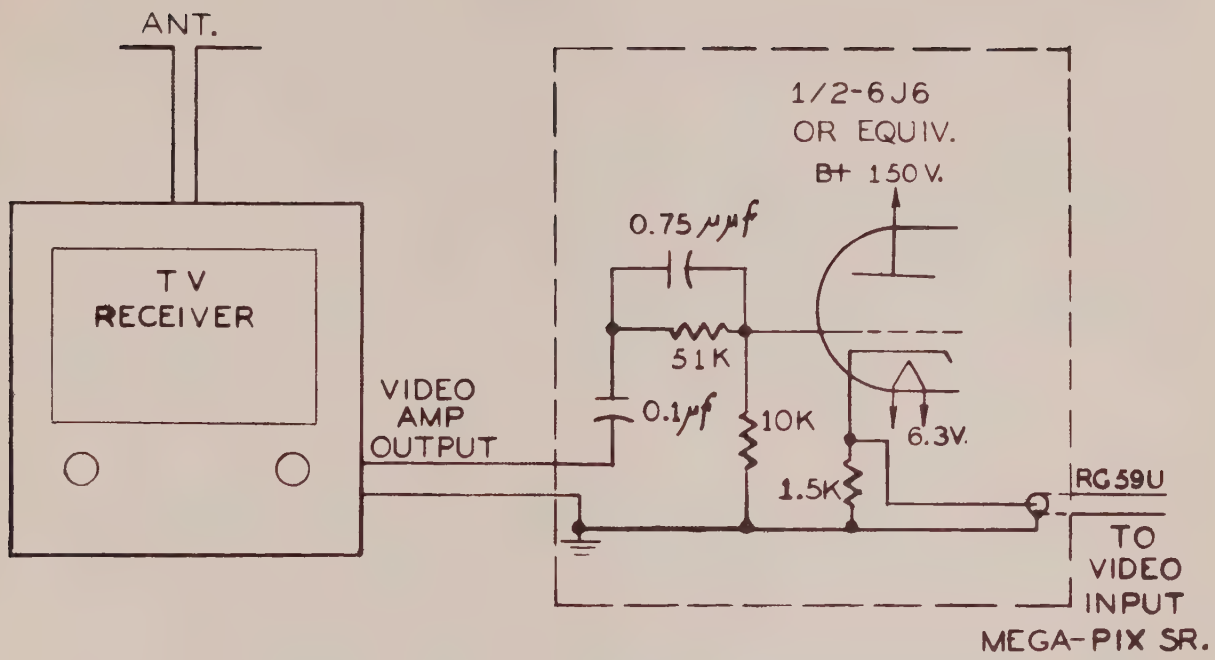


Figure 3. Connecting Mega-Pix Sr. Using a TV Receiver As a Video Modulation source.

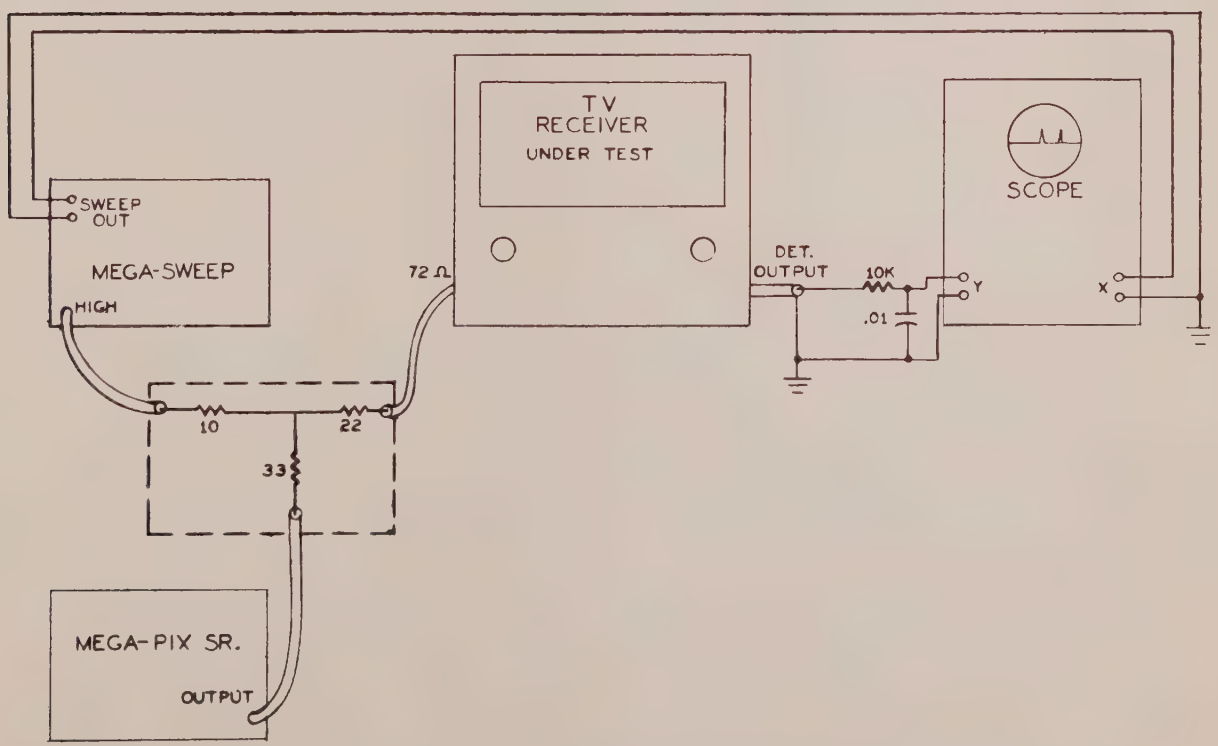


Figure 4. Connecting Mega-Pix Sr. For Visual Alignment of a TV Receiver.

SECTION III

OPERATING INSTRUCTIONS

1. DESCRIPTION OF CONTROLS.

The function of each control and connector is described below; detailed operational procedures for these controls are described in paragraph two of this section.

1-1. TELEVISION CHANNEL SELECTION. (S-1, S-2) This rotary switch selects the TV channel output of the Mega-Pix Sr. Both sound and picture channel selection is accomplished by this single control.

1-2. POWER ON-OFF (S-13). This toggle switch controls the a-c power to the equipment. In the ON position the equipment is in operation.

1-3. AUDIO CONTROLS.

a. EXTERNAL INPUT TERMINALS (J-1). - These terminals are for use when an external audio source is to be used to modulate the sound carrier. See general description section for specifications of external audio signal input circuit.

b. SOUND CARRIER ON-OFF SWITCH (S-3). - This toggle switch determines the ON-OFF condition of the sound carrier. All plate potentials to the sound carrier circuits are removed when this switch is in the OFF position.

c. AUDIO EXT-INT SWITCH (S-12). - This toggle switch, when in the INT position, applies a 400 cycle audio signal to the sound carrier's modulator circuit. When S-12 is in the EXT position, the audio circuit is adapted to accept an external signal applied to the EXTERNAL INPUT terminals.

d. DEVIATION CONTROL (R-2). - This control provides an adjustment of the sound carrier's deviation to a maximum of ± 25 kc.

e. CARRIER LEVEL CONTROL (R-57). - Sound carrier amplitude is adjustable by this control, thereby permitting individual adjustment of sound and picture carrier levels fed through the common output circuit.

1-4. VIDEO CONTROLS.

a. VIDEO INPUT CONNECTOR (J-2). - The video signal used to modulate the picture carrier is applied to the INPUT connector. Refer to Specifications, Section I, for input signal requirements; refer to Installation, Section II, for methods of connecting video input signal.

b. MODULATION ON-OFF SWITCH (S-5). - This toggle switch permits the removal of all modulation from the picture carriers without disturbing the setting of the MODULATION control.

c. CARRIER ON-OFF SWITCH (S-4). - This toggle switch determines the ON-OFF condition of the picture carrier. All plate potentials to the sound carrier circuits are removed when this switch is in the OFF position.

d. MODULATION LEVEL CONTROL (R-89). - This control determines the modulation percentage of the picture carrier. With this control, the picture signal modulation is adjustable between zero and 90 percent.

1-5. R-F OUTPUT CONTROLS. - The r-f output controls consist of attenuator switches S-7 through S-11. These switches provide 20 db, 20 db, 10 db, 6 db and 3 db attenuation of the output signal when in the up position. An additional control over the output is accomplished by R-97 and R-100, the variable output attenuator. The r-f output signal appears at J-3, designated OUTPUT. (See Section I for specifications.)

1-6. CHASSIS CONTROLS. - There are two controls on the right side of the chassis that may require operational attention. These are:

a. D.C. RESTORER SWITCH (S-6). - This switch (unless otherwise specified) is factory-set to the ON position.

b. VIDEO MODULATION LINEARITY CONTROL (R 83). - This control is factory-set (unless otherwise specified) for best suppressor grid bias on the video modulator stage, V-11. If the d-c restorer is removed from the circuit (S-6, OFF) this control may have to be reset for a different suppressor bias voltage on V-11.

2. OPERATION.

It is assumed that the Mega-Pix Sr. has been connected to the circuit under test and to the auxiliary equipment (where employed) in accordance with the instructions contained in Section II, Installation. (Refer to Figures 2 and 3.)

The following is a list of general operating instructions:

a. Plug power cord into a 117V, 50-60 cps outlet. Turn POWER ON-OFF switch (S-13) ON; allow 5 minutes for warm-up.

b. Initially rotate both CARRIER controls (R-57, R-93) to mid-positions; throw both carrier switches (S-3, S-4) to the ON positions; rotate DEVIATION (R-2) and MODULATION (R-89) to ZERO (CCW).

c. Adjust the attenuator controls for the desired picture carrier level. (In applications where the carrier levels are significant, an r-f signal voltage measuring device such as the Kay Electric Co. Megalyzer should be employed.)

d. Adjust the sound CARRIER level control for the desired carrier amplitude.

e. If video modulation is to be employed, throw the modulation switch, S 5, to the ON position; rotate the MODULATION control, R-89, for the desired video modulation level. (Over-modulation is indicated by a blurring of the picture. In TV receivers employing intercarrier sound, an audio buzz in the sound output will accompany excessive video modulation.)

f. Throw the EXT-INT switch (S-12) to the desired position (INT provides an internal 400 cps tone modulation); advance the DEVIATION control (R-2) clockwise for the desired sound carrier deviation.

3. OPERATION OF MEGA-PIX SR. AS A MARKER GENERATOR.

The Mega-Pix Sr. when employed as a precision frequency marker generator should be connected as described in Section II. (Refer to Figure 4.) In this application, both modulation switches (S-5 and S-12) should be thrown to the OFF positions. The carrier and attenuator controls should be set for the desired marker levels.

Operate the associated sweep generator (Mega-Sweep) and oscilloscope in accordance with instructions contained in the Mega-Sweep instruction book.

SECTION IV

THEORY OF OPERATION

1. GENERAL.

The Mega-Pix Sr. is basically comprised of a picture carrier signal generating and modulating circuits and a sound carrier generating and modulating circuits.

These two basis subsections of the unit, complete with their modulators, are electrically isolated, the only common connections being the plate and heater voltage supply and r-f output network.

2. CIRCUIT DESCRIPTION.

2-1. PICTURE SIGNAL CIRCUITS. - The picture signal is generated by crystal oscillator V-8, followed by a series of frequency multipliers V-9 and V-10 and a video modulator stage, V-11. The video modulation signal input is first amplified by V-13 and applied to the suppressor grid of V-11; V-12 provides d-c restoration of the video signal.

a. CRYSTAL OSCILLATOR-MULTIPLIER (V-8). - The crystal oscillator multiplier stage, a 12AT7 dual triode, functions as a cathode coupled oscillator. The crystal, one for each channel, is selected by two sections of S-2 (b & c). The A section of V-8 is resonated at the crystal fundamental frequency; the B section of V-8 is resonated at the third harmonic.

b. MULTIPLIER (V-9). - The output of V-8 in the 30 mc region is coupled through C-99 to V-9, a 6AH6 pentode. This stage further multiplies the frequency by two or three times as determined by the channel in use.

c. MULTIPLIER (V-10). - This stage, employing a 6AK5 pentode, operates as a straight amplifier on channels 2 through 5. For channels 6 through 13, V-10 operates as a doubler. The output of V-10 is fed out of the video switch assembly compartment (J-5) through a shielded coaxial cable to the video modulator section.

d. MODULATOR (V-11). - This stage, a 6AS6 pentode, amplitude modulates the r-f output of the picture signal circuit. The stage functions as an amplifier for the r-f signal. A video signal, applied to the suppressor grid of the tube, causes the transconductance of the stage to vary in accordance with the applied video signal. The resultant is an amplitude modulated r-f signal appearing at the plate of V-11. This is coupled through R-93, the VIDEO CARRIER level control, to the output attenuator network.

e. D-C RESTORER (V-12). - The d-c restorer, when connected by S-6, maintains a negative-going d-c level at the suppressor grid of V-11. With S-6 in the OFF position, V-12 is removed from the circuit. Under this condition the fixed negative bias applied to the suppressor of V-11 is adjustable by R-83, connected in the V-11 cathode circuit. The bias voltage is then adjusted for the most linear video modulation condition.

f. VIDEO AMPLIFIER (V-13). - This stage, a 6AH6 pentode, functions as an amplifier for the input video signal to be applied for modulation of the picture carrier. The stage operates as a conventional class A amplifier with input signal voltage adjustable by R-89. The output signal from V-13 is coupled through L-27 and

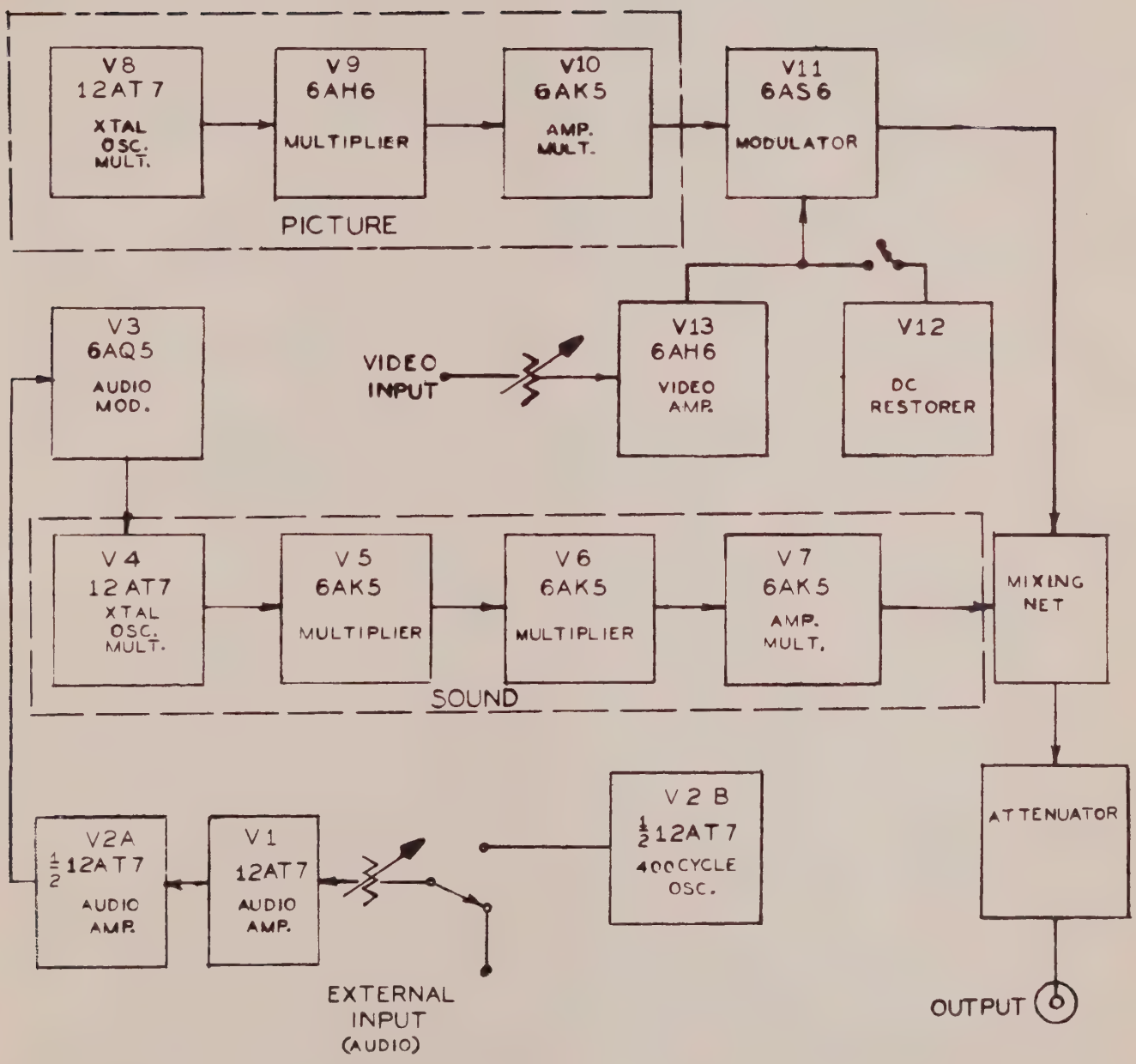


Figure 5. Mega-Pix Sr. Functional Block Diagram.

R-91, a high frequency peaking network, before presentation to the modulator stage.

2-2. SOUND SIGNAL CIRCUITS. The sound carrier is generated by the crystal oscillator-multiplier stage, V-4, frequency multiplied by V-5 and V-6, and amplified by V-7. Frequency modulation of the sound carrier is accomplished by audio amplifier V-1, amplifier V-2, and modulator V-3. One triode section of V-2 also functions as a 400 cycle audio oscillator.

a. CRYSTAL OSCILLATOR-MULTIPLIER (V-4). - This stage, employing a 12AT7, is a cathode-coupled oscillator multiplier; it is similar in circuitry to the V-8 stage with the exception of the variable inductor, L-2, connected in series with the crystal to effect frequency modulation of the oscillator's output.

b. FREQUENCY MULTIPLIER (V-5). - The r-f output in the 30 mc region is further multiplied by V-5. On channels 2 through 5, the stage functions as a doubler; on channels 6 through 13, the stage is a tripler.

c. FREQUENCY MULTIPLIER (V-6). - This stage functions as straight amplifier on channels 2 through 6. On channels 7 through 13 the stage operates as a frequency doubler.

d. R-F AMPLIFIER STAGE (V-7). - This stage, using a 6AH6 pentode, functions as a straight broad-band r-f amplifier. The output signal is coupled through C-75 to R-57, the sound carrier level control, then through a shielded coaxial cable to the output attenuator network.

e. AUDIO AMPLIFIER (V-1). - When S-12 is in the EXT position, the audio signal applied to J-1 is fed to the DEVIATION control, R-2, then to the input of the first triode section of V-1. The output of the first triode section of V-1 is coupled through C-3 to the second triode section operating as a cathode-loaded amplifier. The output of the cathode-loaded stage is coupled to the audio pre-emphasis network consisting of C-4, R-7 and R-8.

f. AUDIO AMPLIFIER (V-2A). - This stage, employing one triode section of a 12AT7, amplifies the output of the pre-emphasis network to the level sufficient to drive the modulator, V-3.

g. AUDIO OSCILLATOR (V-2B). - This stage, using one triode of a 12AT7, is an r-c audio oscillator with an oscillating frequency of 400 cps. This stage receives plate voltage through one section of S-12 and the other section of S-12 connects the 400 cps oscillator's output to the input of the audio amplifier.

h. AUDIO MODULATOR (V-3). - The audio output of V-2A is coupled through C-11 to the audio frequency band-pass network (L-3, L-4, C-12, C-13, C-14) to the grid of V-3, a 6AQ5 power pentode. The output of V-3 is connected to L-1; L 1 functions as the control winding of a saturable reactor. The current through L-1 affects the permeability of the core of L-2. This change in permeability causes a variation in the inductance of L-2; L-2, connected in the crystal oscillator, V-4 circuit, causes a proportional variation in the oscillating frequency crystal resulting in frequency modulation of the r-f signal. R-24 provides a linearity adjustment for the modulator.

2-3. OUTPUT ATTENUATOR NETWORK. The r-f outputs of the sound carrier circuits and the picture carrier circuits are combined in a network consisting of R-94, R-95 and R-96, then fed to the attenuator network. The attenuator consists of one variable control, R-97 and R-100, plus a set of fixed pads placed in the circuit by switches S-7 through S-11. A total of 59 db of fixed attenuation is available with the full attenuator network.

SECTION V

MAINTENANCE

1. ALIGNMENT AND MAINTENANCE ADJUSTMENTS.

1-1. PICTURE R-F CIRCUIT ALIGNMENT. - To align the picture signal r-f generator stages, perform the following:

a. Set the channel selector (S-1, S-2) at channel 13. Rotate C-96 to near minimum capacity.

b. Connect a vacuum tube voltmeter to TP-7; peak L-16 for maximum meter indication.

c. Rotate S-1, S-2 to each of the remaining 11 channels, adjusting the capacitor placed across L-16 by S-2A for a maximum indication on the VTVM. Check the resonant frequency of L-16 with a calibrated grid-dip meter after each capacitor adjustment; the measured frequency should be the same as that listed in the frequency chart.

d. Return S-1 and S-2 to channel 13; move VTVM to TP-8. Adjust L-17 for a peak on the VTVM. Check the frequency at L-17 with a grid-dip meter. For each of the remaining channels, adjust the capacitors connected by S-2d for a peak on the VTVM. Compare the frequencies measured with a grid-dip meter at L-17 with those listed in Figure 9.

e. Repeat (as described in preceding step), adjusting L-18 (on channel 13) and the capacitors connected by S-2e on the remaining channels.

f. Adjust the inductor or capacitor selected by S-2f for maximum picture signal output on each channel. (This may be measured with a sensitive device such as a Megalyzer or a TV receiver adapted for signal strength measurements.)

1-2. SOUND R-F CIRCUIT ALIGNMENT. - The alignment of the sound carrier circuits is similar to the picture circuits. Follow the same instructions as contained in 1-1, only adjust and check with grid-dip meter, L-5, L-6, and L-28, instead of L-16, L-17 and L-18, respectively. In starting the tune-up process, be sure to initially set C-34 at near minimum capacity, set EXT-INT switch to EXT position and rotate DEVIATION control fully counterclockwise. ALL pertinent frequencies are listed on the chart in Figure 9.

1-3. CHANNEL FREQUENCY ADJUSTMENTS. - After completion of the alignment adjustments, the frequency of each channel should be set to the exact frequency. A test point is provided on each of the crystal oscillator stages for connecting an external frequency measuring device. These are TP-2 and TP-6. Adjust the capacitors connected by S2a for setting the picture carrier crystal frequencies listed in Figure 9; adjust the capacitors connected by S1b for the sound carrier frequencies listed in the frequency chart, Figure 9. In adjusting the carrier frequencies the voltages measured at test points 1 and 7 should be above 12 volts d-c as measured with a VTVM.

1-4. VIDEO PEAKING INDUCTOR (L-27). - This coil functions as a series-peaking inductance in the VIDEO modulation circuit. The coil should be adjusted for a flat video frequency response. For best results, a Model Video Marka-Sweep, an oscilloscope, and an adapted TV receiver (with direct connections to the video second

detector) should be employed. The TV receiver should have a flat response capability to 5 mc.

A zero to 5 mc signal generator and a VTVM in conjunction with the adapted TV receiver may also be used.

a. Connect Model Video (or 0-5 mc signal generator) to the video input connector; connect Mega-Pix Sr. output to TV receiver output terminals; connect oscilloscope Y deflection input (or VTVM) directly to the TV receiver's video detector. (Connect Model Video's sweep and pip output as shown in the Model Video instruction book.)

b. Adjust L-27 for a flat response within the 0-5 mc frequency range. (Be sure that the MODULATION level is adjusted for less than 90% modulation.)

Note

An alternate method for adjusting L-27 is to connect the oscilloscope or VTVM to Pin 7 of V-11 through a .01 mf capacitor and a detector circuit. Then proceed as described above. This eliminates the need for a TV receiver of flat response.

1-5. D-C RESTORER SWITCH (S-6). - This switch, when in the ON position, provides d-c restoration for the video modulation signal at the video signal input to the modulator stage. For normal operation, this switch should be in the ON position. For special applications requiring an absolute linear video modulation capability, the d-c restorer may be removed from the modulation circuit by throwing S-6 to the OFF position; the modulator suppressor bias may then be adjusted for best modulation linearity. (See next paragraph.)

1-6. VIDEO MODULATION LINEARITY CONTROL (R-83). - This control determines the negative bias voltage applied to the video modulator suppressor grid. When using the d-c restorer (S-6 in the ON position) this control should be adjusted for best linearity.

When the d-c restorer is not in use (S-6 OFF), R-83 should be re-set for best video modulation linearity.

1-7. AUDIO DEVIATION LINEARITY CONTROL (R-24). - This control should be adjusted for best deviation linearity; i.e., equal carrier swing above and below the center frequency. Adjust R-24 with the aid of a suitable frequency deviation measuring instrument. After adjusting R-24, reset the center frequency of the sound carrier as described in paragraph 1-3.

2. TROUBLE LOCATION.

The following should aid in location of trouble within the equipment. In case of failure, it is advised first to be sure the difficulty is not with the TV receiver under test, the video or audio modulation sources, the interconnecting cables, or any other associated equipment. For location of trouble in the Mega-Pix Sr., the information that follows should be of aid. If the trouble is not included in the Trouble Location Chart, proceed to isolate the trouble to one section, then to a particular stage. Refer to Figure 8 for typical tube socket voltage measurements.

TROUBLE LOCATION CHART

SYMPTOM	POSSIBLE CAUSE AND CORRECTION
Picture signal failure on all channels; sound signal O.K.	Check tubes V-8, V-9, V-10, and V-11. Trace signal at test points, starting with OSC (V-8) stage.
Sound signal failure on all channels; picture signal O.K.	Check tubes V-4, V-5, V-6, and V-7. Trace signal at test points, starting with OSC (V-4) stage.
Sound or picture signal failure on one channel only.	Check crystal of bad channel; check selector switch (S-1 or S-2) for poor contact. Trace signal using test points. Substitute new oscillator-multiplier tube.
No modulation of sound carrier when in EXT position; INT O.K.	Check external modulation source.
No modulation of sound carrier in either EXT or INT positions.	Check Tubes V-1, V-2, or V-3. Check tube pin voltages in V-1, V-2, and V-3 stages.
No modulation of sound carrier in INT position; EXT modulation O.K.	Check V-3; check S-12 contacts. Check tube pin voltages on V-2.
No video modulation of picture carrier.	Check V-11 and V-13; check V-12; check tube pin voltages on V-11, V-12 and V-13.
Blurred or distorted picture on TV receiver's screen.	Excessive modulation - lower with modulation control. Check V-11; check V-12 and V-13.

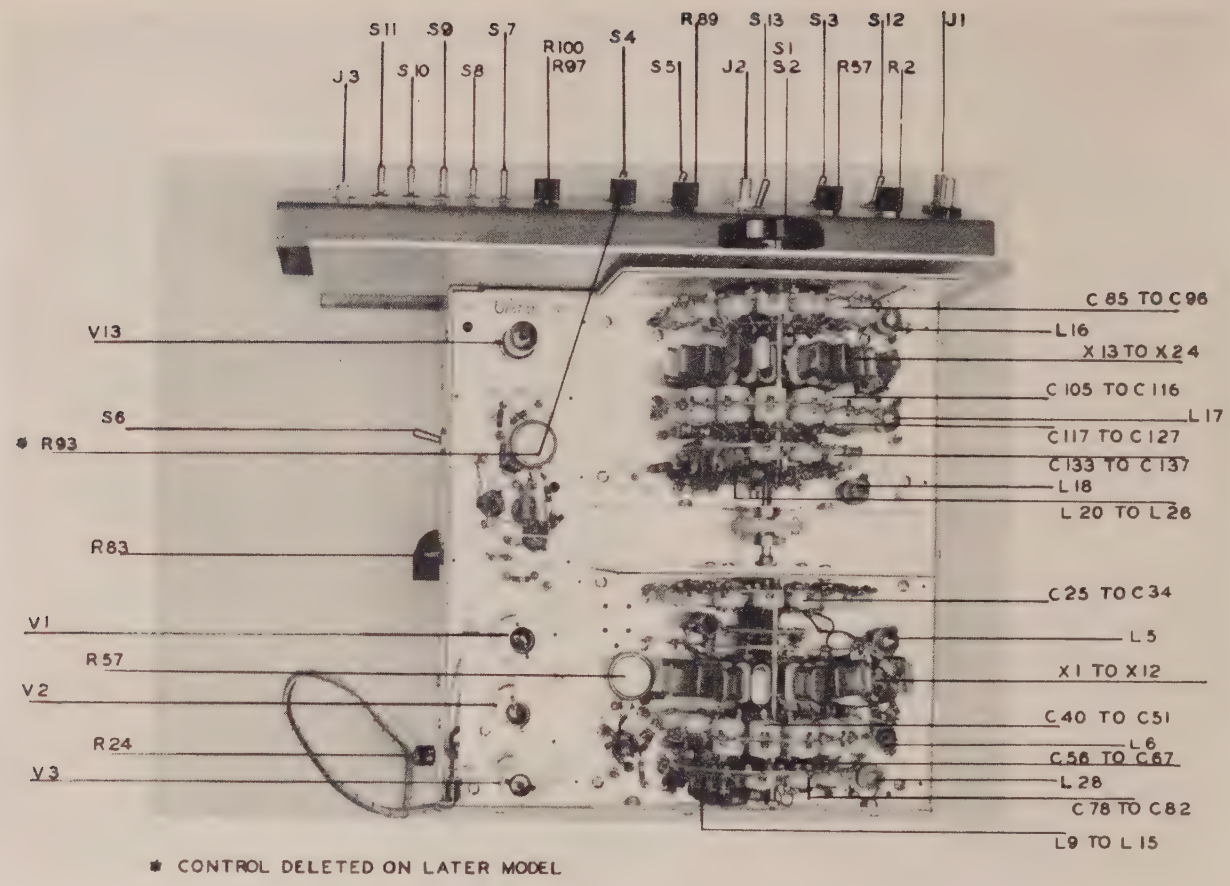


Figure 6. Mega-Pix Sr. Top View.

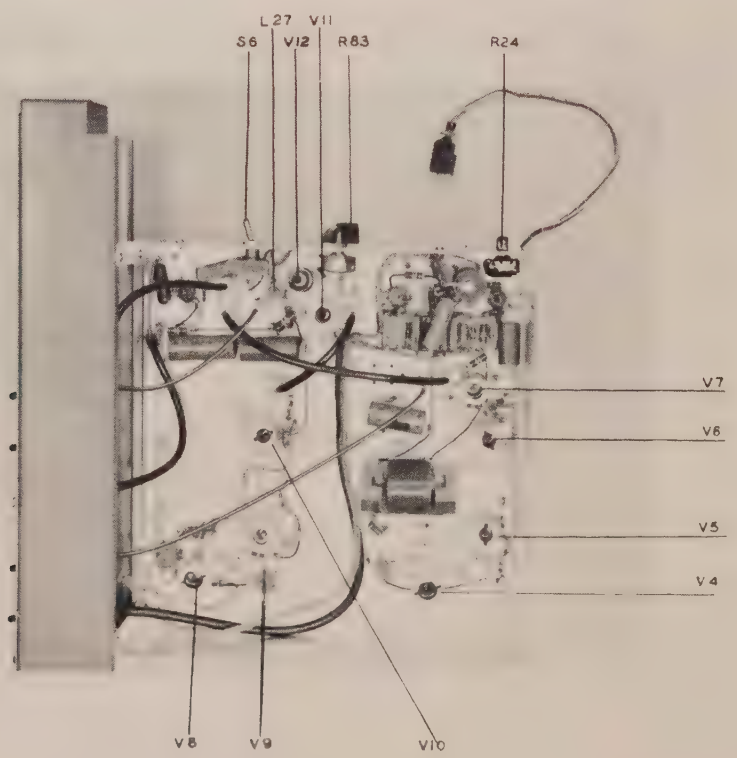
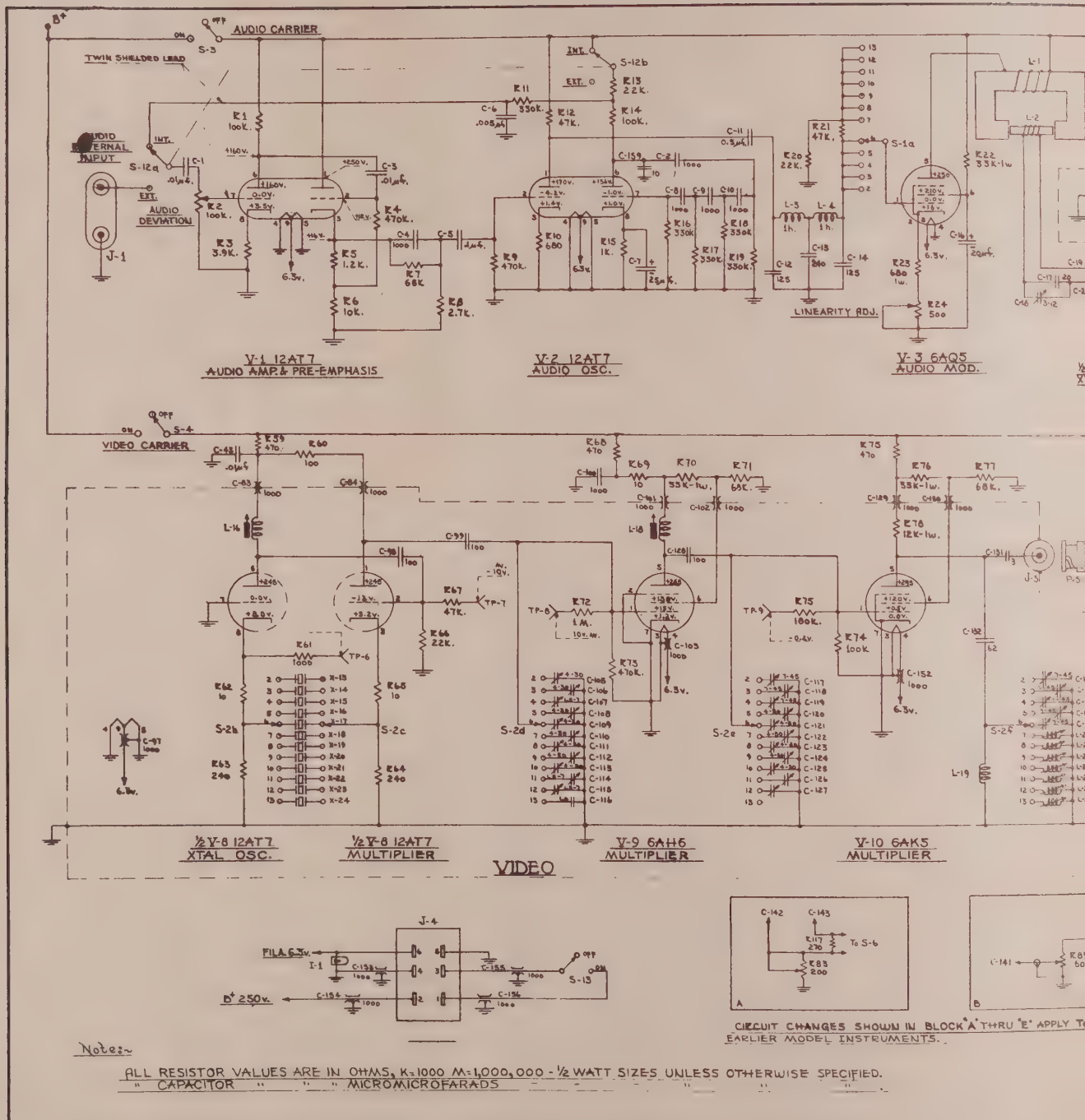
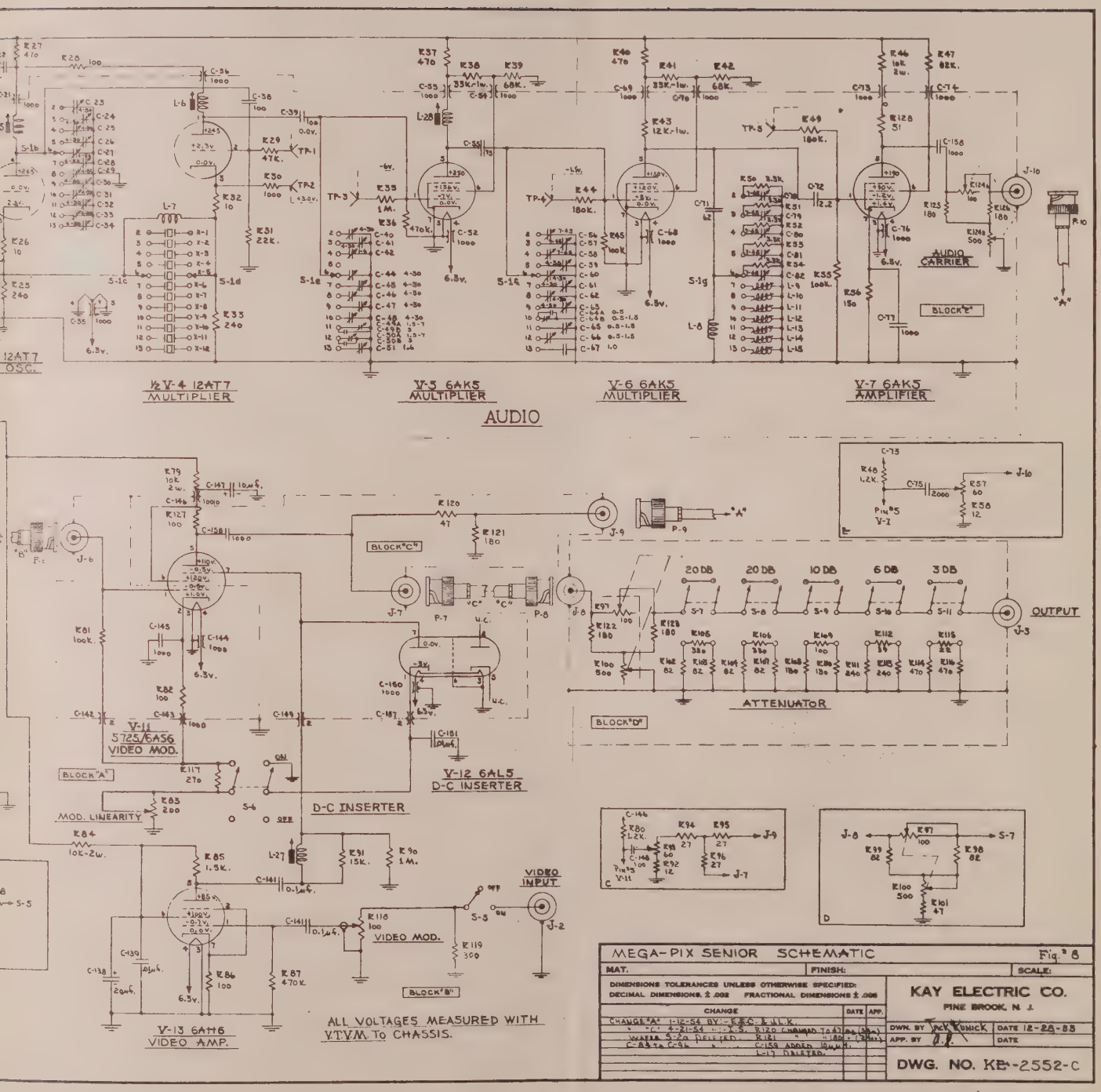


Figure 7. Mega-Pix Sr. Bottom View.



Note:-

ALL RESISTOR VALUES ARE IN OHMS, K=1000 M=1,000,000 - ½ WATT SIZES UNLESS OTHERWISE SPECIFIED.
" CAPACITOR " " " MICROMICROFARADS



MEGA-PIX SENIOR SCHEMATIC		Fig. # 8
MAT.	FINISH:	SCALE:

DIMENSIONS TOLERANCES UNLESS OTHERWISE SPECIFIED:
DECIMAL DIMENSIONS ± .002 FRACTIONAL DIMENSIONS ± .006

CHANGE	DATE	APP.
CHANGE "A" 1-12-54 BY:- E.E.C. & J.L.K.		
" "C" 4-21-54 " " " R120 CHANGED TO 47		
WAFER S-2a DELETED. R121 " " 180Ω + 120Ω		
C-88 to C-94 " " C-159 ADDED 10μμf.		
L-17 DELETED.		

KAY ELECTRIC CO.
PINE BROOK, N. J.

DWN. BY JACK DONICK DATE 12-28-53
APP. BY DATE

DWG. NO. KE-2552-C

MODIFIED
SEE ADDENDUM
AT REAR OF BOOK

AUDIO

Channel	Switch S-1a	Switch S-1b	Switch S-1c Xtal Sym.	Switch S-1d Frequency (Mc)	Switch S-1e		Switch S-1f		Switch S-1g	
					Comp.	Freq. (Mc)	Comp.	Freq. (Mc)	Comp.	Freq. (Mc)
2	-	C-23	X-1	9.9583 mc.	C-40	29.875	C-56	59.75	C-78	59.75
3	-	C-24	X-2	10.9583 ".	C-41	32.875	C-57	65.75	C-79	65.75
4	-	C-25	X-3	11.9583 ".	C-42	35.875	C-58	71.75	C-80	71.75
5	-	C-26	X-4	(9.0833) ". 10.2187 ".	—	(27.250) 30.8745	C-59	81.75	C-81	81.75
6	-	C-27	X-5	9.7500 ".	C-44	29.250	C-60	87.75	C-82	87.75
7	-	C-28	X-6	9.9861 ".	C-45	29.958	C-61	89.875	L-9	179.75
8	-	C-29	X-7	10.3194 ".	C-46	30.958	C-62	92.875	L-10	185.75
9	-	C-30	X-8	10.6527 ".	C-47	31.958	C-63	95.875	L-11	191.75
10	-	C-31	X-9	10.9861 ".	C-48	32.958	C-64A&B	98.875	L-12	197.75
11	-	C-32	X-10	11.3194 ".	C-49A&B	33.958	C-65	101.875	L-13	203.75
12	-	C-33	X-11	11.6527 "	C-50A&B	34.958	C-66	104.875	L-14	209.75
13	-	C-34	X-12	11.9861 "	C-51	35.958	C-67	107.875	L-15	215.75

VIDEO

Channel	Switch S-2a	Switch S-2b Xtal Sym.	Switch S-2c Frequency	Switch S-2d		Switch S-2e		Switch S-2f	
				Comp.	Freq.	Comp.	Freq.	Comp.	Freq.
2	C-85	X-13	(9.2083 Mcs.) 27.625 ".	C-105	27.625mc	C-117	55.25mc	C-133	55.25mc
3	C-86	X-14	(10.2083 Mcs.) 30.625 ".	C-106	30.625"	C-118	61.25 "	C-134	61.25 "
4	C-87	X-15	(11.2083 " .) 33.625 ".	C-107	33.625	C-119	67.25 "	C-135	67.25 "
5	C-88	X-16	(8.5833 ".) 25.750 ".	C-108	25.750	C-120	77.25 "	C-136	77.25 "
6	C-89	X-17	(9.2500 ".) 27.750 ".	C-109	27.750	C-121	83.25 "	C-137	83.25 "
7	C-90	X-18	(9.7361 ".) 29.208 ".	C-110	29.208	C-122	87.625"	L-20	175.25 "
8	C-91	X-19	(10.0694 ".) 30.208 ".	C-111	30.208	C-123	90.625"	L-21	181.25 "
9	C-92	X-20	(10.4027 ".) 31.208 ".	C-112	31.208	C-124	93.625"	L-22	187.25 "
10	C-93	X-21	(10.7361 ".) 32.208 ".	C-113	32.208	C-125	96.625"	L-23	193.25 "
11	C-94	X-22	(10.0694 ".) 33.208 ".	C-114	33.208	C-126	99.625"	L-24	199.25 "
12	C-95	X-23	(11.4027 ".) 34.208 ".	C-115	34.208	C-127	102.625"	L-25	205.25"
13	C-96	X-24	(11.7361 ".) 35.208 ".	C-116	35.208	—	105.625"	L-26	211.25 "

Note:-
XTAL FREQUENCIES SHOWN IN PARENTHESIS USED IN EARLIER MODEL INSTRUMENTS.

Figure 9. Alignment Frequency Chart.

MEGA-PIX SENIOR

PARTS LIST

Tubes

V-1	12AT7	V-7	6AK5
V-2	12AT7	V-8	12AT7
V-3	6AQ5	V-9	6AH6
V-4	12AT7	V-10	6AK5
V-5	6AK5	V-11	6AS6
V-6	6AK5	V-12	6AL5
		V-13	6AH6

Resistors (All resistors are 1/2 watt unless otherwise specified.)

R-1	100K	R-37	470 ohms
R-2	100K, Audio Deviation Pot.	R-38	33K, 1 watt
		R-39	68K
R-3	3.9K	R-40	470 ohms
R-4	470K	R-41	33K, 1 watt
R-5	1.2K	R-42	68K
R-6	10K	R-43	12K, 1 watt
R-7	68K	R-44	180K
R-8	2.7K	R-45	100K
R-9	470K	R-46	10K, 2 watts
R-10	680 ohms	R-47	82K
R-11	330K	R-48	1.2K
R-12	47K	R-49	180K
R-13	22K	R-50	3.3K
R-14	100K	R-51	3.3K
R-15	1K	R-52	3.3K
R-16	330K	R-53	3.3K
R-17	330K	R-54	3.3K
R-18	330K	R-55	100K
R-19	330K	R-56	150 ohms
R-20	22K	R-57	60 ohms, Audio Carrier Pot.
R-21	47K	R-58	12 ohms
R-22	33K, 1 watt	R-59	470 ohms
R-23	680 ohms, 1 watt	R-60	100 ohms
R-24	500 ohms	R-61	1000 ohms
R-25	240 ohms	R-62	10 ohms
R-26	10 ohms	R-63	240 ohms
R-27	470 ohms	R-64	240 ohms
R-28	100 ohms	R-65	10 ohms
R-29	47K	R-66	22K
R-30	1000 ohms	R-67	47K
R-31	22K	R-68	470 ohms
R-32	10 ohms	R-69	10 ohms
R-33	240 ohms	R-70	33K, 1 watt
R-34	omitted	R-71	68K
R-35	1 Megohm	R-72	1 Megohm
R-36	470K	R-73	470K

Resistors (Continued)

R-74	100K	R-96	27 ohms	R-121	240 ohms
R-75	470 ohms	R-97	100 ohms, pot.	R-122	180 ohms
R-76	33K, 1 watt	R-98	82 ohms	R-123	180 ohms
R-77	68K	R-99	82 ohms	R-124A	100 ohms
R-78	12K, 1 watt	R-100	500 ohms, pot.	R-124B	500 ohms
R-79	10K, 2 watts	R-101	47 ohms	R-125	180 ohms
R-80	1.2K	R-102	82 ohms	R-126	180 ohms
R-81	100K	R-103	82 ohms	R-127	100 ohms
R-82	100 ohms	R-104	82 ohms	R-128	51 ohms
R-83	200 ohms, Mod. Linearity Pot.	R-105	330 ohms		
		R-106	330 ohms		
R-84	10K, 2 watts	R-107	82 ohms		
R-85	1.5K	R-108	130 ohms		
R-86	100 ohms	R-109	100 ohms		
R-87	470K	R-110	130 ohms		
R-88	12 ohms	R-111	240 ohms		
R-89	60 ohms, Video Mod. Pot.	R-112	39 ohms		
		R-113	240 ohms		
R-90	1 Megohm	R-114	470 ohms		
R-91	15K	R-115	22 ohms		
R-92	12 ohms	R-116	470 ohms		
R-93	60 ohms Video Carrier Pot.	R-117	270 ohms		
		R-118	100 ohms Video Mod. Pot.		
R-94	27 ohms	R-119	300 ohms		
R-95	27 ohms	R-120	39 ohms		

Capacitors

C-1	.01 mf	C-30	4-30 mmf, padder
C-2	1000 mmf, F.T.	C-31	4-30 mmf, padder
C-3	.01 mf	C-32	4-30 mmf, padder
C-4	1000 mmf	C-33	4-30 mmf, padder
C-5	0.1 mf	C-34	4-30 mmf, padder
C-7	25 mf, Electrolytic, 25V	C-35	1000 mmf, F.T.
C-8	1000 mmf	C-36	1000 mmf, F.T.
C-9	1000 mmf	C-38	100 mmf
C-10	1000 mmf	C-39	100 mmf
C-11	0.5 mf	C-40	4-30 mmf, padder
C-12	125 mmf	C-41	4-30 mmf, padder
C-13	240 mmf	C-42	4-30 mmf, padder
C-14	125 mmf	C-43	.01 mf
C-16	20 mf, Electrolytic	C-44	4-30 mmf, padder
C-17	20 mmf	C-45	4-30 mmf, padder
C-18	3-12 mmf, padder	C-46	4-30 mmf, padder
C-19	2 mmf, F.T.	C-47	4-30 mmf, padder
C-20	2 mmf, F.T.	C-48	4-30 mmf, padder
C-21	1000 mmf, F.T.	C-49A	1.5-7 mmf, padder
C-22	0.01 mf	C-49B	3 mmf
C-23	4-30 mmf, padder	C-50A	1.5-7 mmf, padder
C-24	4-30 mmf, padder	C-50B	3 mmf
C-25	4-30 mmf, padder	C-51	1-6 mmf, padder
C-26	4-30 mmf, padder	C-52	1000 mmf, F.T.
C-27	4-30 mmf, padder	C-53	1000 mmf, F.T.
C-28	4-30 mmf, padder	C-54	1000 mmf, F.T.
C-29	4-30 mmf, padder	C-55	75 mmf

Capacitors (Continued)

C-56	7-45 mmf, padder	C-107	1.5-7 mmf, padder
C-57	7-45 mmf, padder	C-108	4-30 mmf, padder
C-58	7-45 mmf, padder	C-109	4-30 mmf, padder
C-59	4-30 mmf, padder	C-110	4-30 mmf, padder
C-60	4-30 mmf, padder	C-111	4-30 mmf, padder
C-61	4-30 mmf, padder	C-112	4-30 mmf, padder
C-62	4-30 mmf, padder	C-113	4-30 mmf, padder
C-63	4-30 mmf, padder	C-114	1.5-7 mmf, padder
C-64A	0.5 mmf	C-115	1.5-7 mmf, padder
C-64B	0.5-1.5 mmf, padder	C-116	1.0 mmf
C-65	0.5-1.5 mmf, padder	C-117	7-45 mmf, padder
C-66	0.5-1.5 mmf, padder	C-118	7-45 mmf, padder
C-67	1.0 mmf	C-119	7-45 mmf, padder
C-68	1000 mmf, F.T.	C-120	4-30 mmf, padder
C-69	1000 mmf, F.T.	C-121	4-30 mmf, padder
C-70	1000 mmf, F.T.	C-122	4-30 mmf, padder
C-71	62 mmf	C-123	4-30 mmf, padder
C-72	2.2 mmf	C-124	4-30 mmf, padder
C-73	1000 mmf, F.T.	C-125	4-30 mmf, padder
C-74	1000 mmf, F.T.	C-126	Special padder
C-75	2000 mmf	C-127	Special padder
C-76	1000 mmf, F.T.	C-128	75 mmf
C-77	1000 mmf	C-129	1000 mmf, F.T.
C-78	7-45 mmf, padder	C-130	1000 mmf, F.T.
C-79	7-45 mmf, padder	C-131	3 mmf
C-80	7-45 mmf, padder	C-132	62 mmf
C-81	7-45 mmf, padder	C-133	7-45 mmf, padder
C-82	7-45 mmf, padder	C-134	7-45 mmf, padder
C-83	1000 mmf, F.T.	C-135	7-45 mmf, padder
C-84	1000 mmf, F.T.	C-136	7-45 mmf, padder
C-85	4-30 mmf, padder	C-137	7-45 mmf, padder
C-86	4-30 mmf, padder	C-138	20 mf, Electrolytic
C-87	4-30 mmf, padder	C-139	.01 mf
C-88	4-30 mmf, padder	C-141	0.1 mf
C-89	4-30 mmf, padder	C-142	2 mmf, F.T.
C-90	4-30 mmf, padder	C-143	1000 mmf, F.T.
C-91	4-30 mmf, padder	C-144	1000 mmf, F.T.
C-92	4-30 mmf, padder	C-145	1000 mmf,
C-93	4-30 mmf, padder	C-146	1000 mmf, F.T.
C-94	4-30 mmf, padder	C-147	10 mf, Electrolytic
C-95	4-30 mmf, padder	C-148	1000 mmf
C-96	4-30 mmf, padder	C-149	2 mmf, F.T.
C-97	1000 mmf, F.T.	C-150	1000 mmf, F.T.
C-98	100 mmf	C-151	.01 mf
C-99	100 mmf	C-152	1000 mmf, F.T.
C-100	1000 mmf, F.T.	C-153	1000 mmf, F.T.
C-101	1000 mmf, F.T.	C-154	1000 mmf, F.T.
C-102	1000 mmf, F.T.	C-155	1000 mmf, F.T.
C-103	1000 mmf, F.T.	C-156	1000 mmf, F.T.
C-105	4-30 mmf, padder	C-157	2 mmf, F.T.
C-106	4-30 mmf, padder	C-158	1000 mmf

Coils

L-1	Osc. Coil	L-15	Special slug-tuned
L-2	Osc. Coil	L-16	Special slug-tuned
L-3	1 henry	L-17	Special slug-tuned
L-4	1 henry	L-18	Special slug-tuned
L-5	Special slug-tuned	L-19	Special
L-6	Special slug-tuned	L-20	Special slug-tuned
L-7	Special	L-21	Special slug-tuned
L-8	Special	L-22	Special slug-tuned
L-9	Special slug-tuned	L-23	Special slug-tuned
L-10	Special slug-tuned	L-24	Special slug-tuned
L-11	Special slug-tuned	L-25	Special slug-tuned
L-12	Special slug-tuned	L-26	Special slug-tuned
L-13	Special slug-tuned	L-27	Special slug-tuned
L-14	Special slug-tuned	L-28	Special

Switches

S-1a, b, c, d, e, f, & g	Rotary - Audio
S-2a, b, c, d, e, & f	Rotary - Video
S-3	S.P.S.T. - Audio carrier
S-4	S.P.S.T. - Video carrier
S-5	S.P.S.T. - Video ON-OFF Input
S-6	D.P.D.T. - D.C. Insertion
S-7 to S-11	D.P.D.T. - Attenuation
S-12a & b	D.P.D.T. - EXT-INT Audio Input
S-13	S.P.S.T. - ON-OFF Line Switch

Fuses

I-1

Test Points

TP-1	Voltage Test	TP-5	Voltage Test
TP-2	Counter Test	TP-6	Counter Test
TP-3	Voltage Test	TP-7	Voltage Test
TP-4	Voltage Test	TP-8	Voltage Test
		TP-9	Voltage Test

Connectors

J-1	General Radio	- Audio External Input
J-2	UG-260/U	- Video Input
J-3	UG-260/U	- Output
J-4	Jones Plug #	- Power Cable
J-5	UG-185/U	- 70 ohms cable connector
J-6	UG-185/U	- 70 ohms cable connector
J-7	UG-185/U	- 70 ohms cable connector
J-8	UG-185/U	- 70 ohms cable connector
J-9	UG-185/U	- 70 ohms cable connector
J-10	UG-185/U	- 70 ohms cable connector
P-5	UG-260/U	
P-6	UG-260/U	
P-7	UG-260/U	
P-8	UG-260/U	
P-9	UG-260/U	
P-10	UG-260/U	

Crystals

X-1	9.9583 mc	X-13	9.2083 mc
X-2	10.9583 mc	X-14	10.2083 mc
X-3	11.9583 mc	X-15	11.2083 mc
X-4	10.2187 mc	X-16	8.5833 mc
X-5	9.7500 mc	X-17	9.2500 mc
X-6	9.9861 mc	X-18	9.7361 mc
X-7	10.3194 mc	X-19	10.0694 mc
X-8	10.6527 mc	X-20	10.4027 mc
X-9	10.9861 mc	X-21	10.7361 mc
X-10	11.3194 mc	X-22	10.0694 mc
X-11	11.6527 mc	X-23	11.4027 mc
X-12	11.9861 mc	X-24	11.7361 mc

MEGA-PIX SENIOR

PARTS LIST

AMENDMENT 4/28/54

CHANGES:

R-120 changed from 39 ohms to 47 ohms
R-121 changed from 240 ohms to 180 ohms

ADDITIONS:

C-159 10 μμf

DELETIONS:

L-17
C-85
C-86
C-87
C-89
C-90
C-91
C-92
C-93
C-94
C-95
C-96
S-2a

POWER SUPPLY 200A INSTRUCTIONS

1. DESCRIPTION.

Power Supply No. 200A is a regulated d-c voltage supply with output voltage adjustable between 225 and 275 volts. The unit operates from a 117V, 60 cps power source. Constructed on an individual chassis, the supply is a completely self-contained unit designed for operation in conjunction with a test instrument requiring a highly stable d-c voltage source. The supply is normally enclosed in the same cabinet housing the associated test unit.

2. POWER SUPPLY CIRCUIT DETAILS.

All d-c plate potentials and 6.3V a-c heater power is supplied by regulated Power Supply 200A.

a. VOLTAGE SUPPLY CIRCUIT. - High voltage is supplied from the secondary of T-1 to the conventional full wave rectifier circuit V-1, a 5U4G dual diode. The rectified output voltage is filtered by C-1, L-1, and C-2. The filtered output voltage is applied to the voltage regulator circuit.

b. VOLTAGE REGULATOR CIRCUIT. - The filtered output voltage is fed through V-2, V-3, and V-4, to the output terminals. V-2, V-3, and V-4 are effectively connected in parallel and function as a variable series resistance to control the output voltage. The remaining stages in the power supply detect and amplify any output voltage changes and feed them to the control stage. They function as follows:

A small voltage increase appearing at the power supply output reflects a relatively large change at the grid of V-6; this is due to the non-linear effect of the neon-glow tubes in the V-6 grid circuit. V-6, its cathode potential regulated, draws higher plate current. This heavier current reflects a lower voltage at the plate of V-6 and the grid of V-5. The V-5 grid, now less positive, results in V-5 drawing less plate current, thereby causing a less positive voltage to appear at its cathode. This less positive voltage is applied to the control grids of the control tubes, V-2, V-3, and V-4, causing them to have a higher plate to cathode resistance thereby lowering the power supply's output voltage.

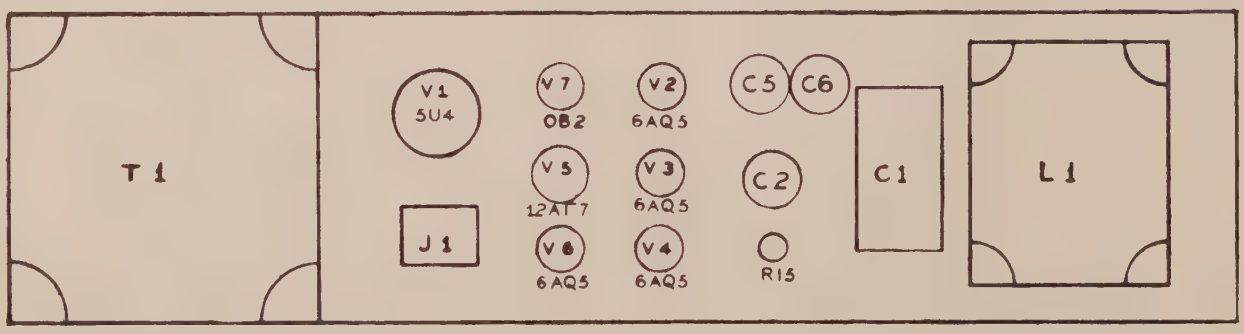
The above described controlling action reverses for a decrease in output voltage. R-15 provides an output voltage adjustment for initially setting the d-c output voltage to the required value.

3. MAINTENANCE.

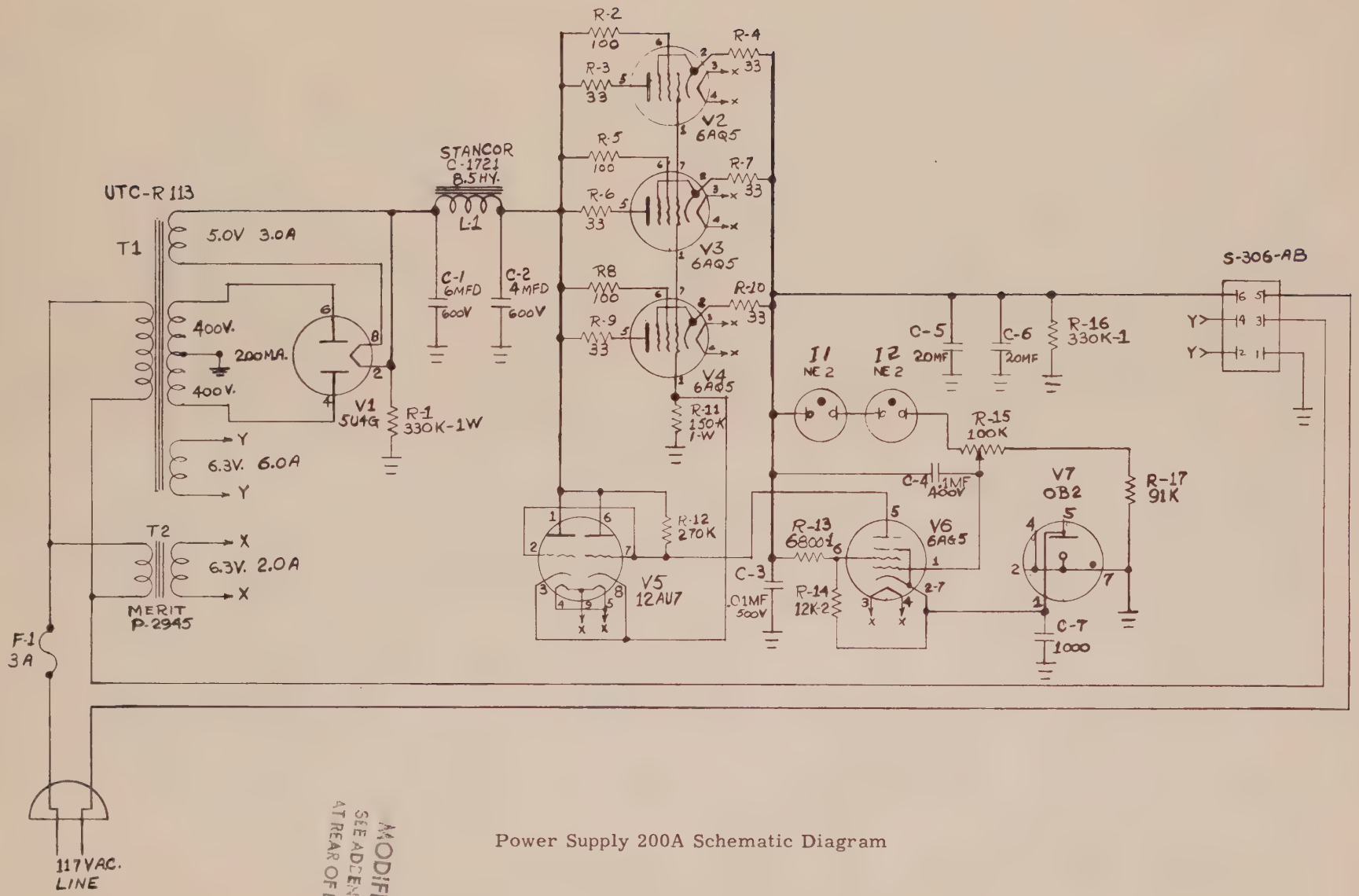
a. VOLTAGE ADJUSTMENT. - The setting of R-15 determines the d-c voltage output of the power supply. To adjust R-15, connect a d-c voltmeter at the B-plus terminals on the associated equipment; with all power on and power supply under full load, set R-15 to the required voltage input for the associated equipment.

b. TROUBLE LOCATION. - The following chart should aid in locating trouble in the power supply:

SYMPTOM	PROBABLE CAUSE AND CORRECTION
1. Zero output voltage from power supply; no heaters light.	Check fuse; if blown, check C-1 and C-2 for short before replacing. Also check V-1 for short. Check a-c wiring; check T-1 and T-2.
2. Zero output voltage, all tubes light.	Check V-1. Check C-2, C-3, C-5 and C-6 for short. Check for open HV winding on T-1; check associated equipment for B-plus short.
3. Low output voltage; poorly regulated.	Check tubes V-1, V-2, V-3, V-4, V-5, V-6 and V-7. Check C-4 and C-7 for shorts. Check R-15, R-17.
4. Voltage output higher than normal. Poor regulation.	Check I-1 or I-2. Open R-15. Check tubes V-5, V-6 and V-7.
5. Excessive ripple in d-c output.	Check C-1 and C-2. Check for excessive load on supply.



Power Supply 200A Tube Locations.



Power Supply 200A Schematic Diagram

POWER SUPPLY 200A

PARTS LIST

Capacitors

C-1	6 mf, 600V	C-5	20 mf
C-2	4 mf, 600V	C-6	20 mf
C-3	.01 mf, 500V	C-7	1000 mmf
C-4	0.1 mf, 400V		

Resistors (All resistors 1/2 watt unless otherwise specified.)

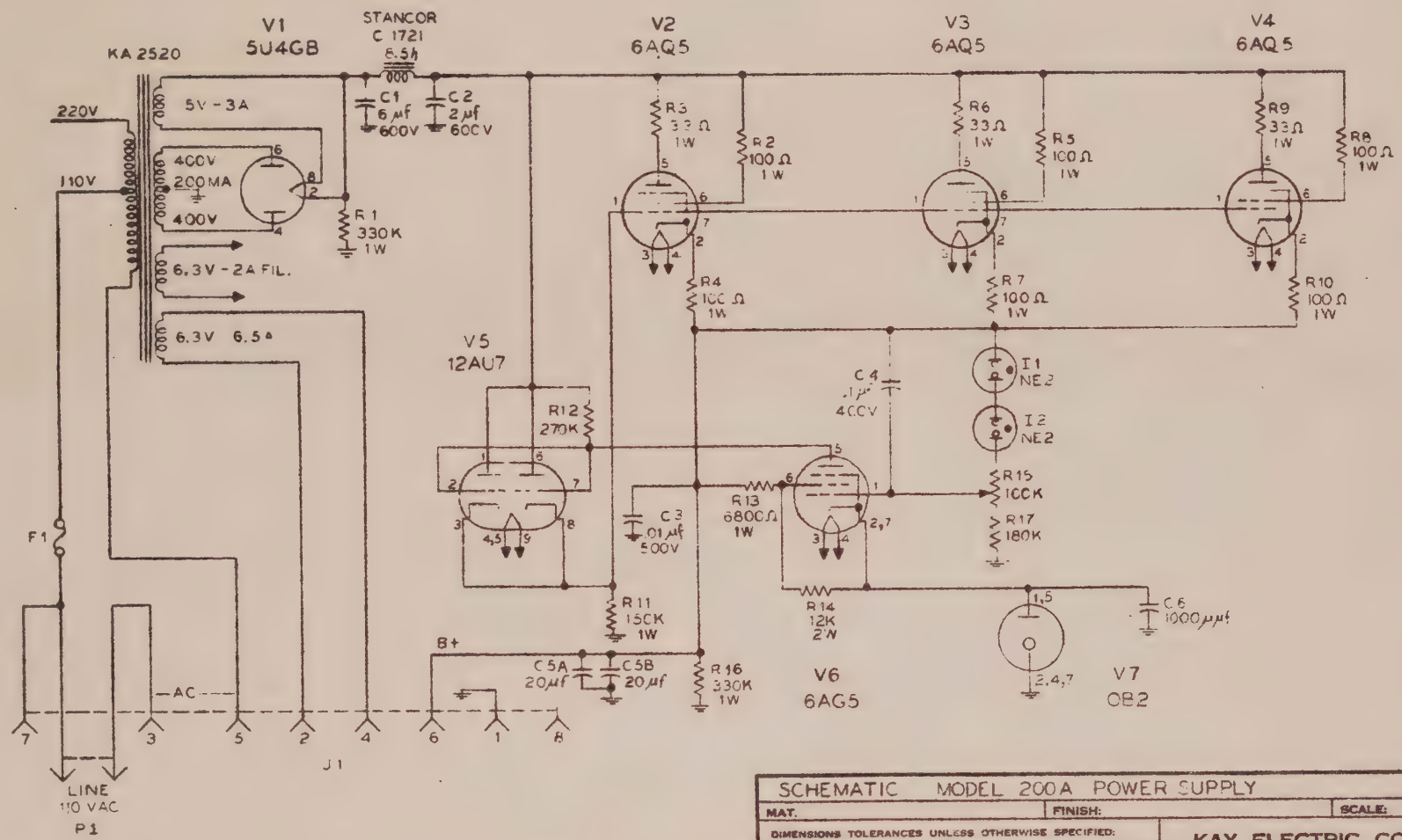
R-1	300K, 1 watt	R-11	150K, 1 watt
R-2	100 ohms	R-12	270K
R-3	33 ohms	R-13	6.8K, 1 watt
R-4	33 ohms	R-14	12K, 2 watts
R-5	100 ohms	R-15	100K, variable
R-6	33 ohms	R-16	330K, 1 watt
R-7	33 ohms	R-17	91K
R-8	100 ohms		
R-9	33 ohms		
R-10	33 ohms		

Miscellaneous

F-1	Fuse; 3A
I-1	NE2
I-2	NE2
L-1	8.5 henry (Stancor C-1721)
T-1	HV-Trans (UTC-R-113)
T-2	FIL-Trans (Merit P-2945)

Tubes

V-1	5U4G
V-2 to V-4	6AQ5
V-5	12AU7
V-6	6AG5
V-7	OD2



SCHEMATIC MODEL 200A POWER SUPPLY

MAT.	FINISH:	SCALE:

DIMENSIONS TOLERANCES UNLESS OTHERWISE SPECIFIED:
DECIMAL DIMENSIONS ± .002 FRACTIONAL DIMENSIONS ± .008

CHANGE	DATE	APP.

KAY ELECTRIC CO.
PINE BROOK, N. J.

DWN. BY A. PIERCE	DATE 11-22-55
APP. BY	DATE

DWG. NO. KB 254

MODEL 200A POWER SUPPLY

PARTS LIST
(Dwg. No. KB 2548-A)

CAPACITORS

C-1 6μF; 600V
C-2 2μF; 600V
C-3 0.01μF; 500V
C-4 0.1μF; 400V
C-5 DUAL ELECTROLYTIC; 2 x 20μF
C-6 1000μμF

TUBES

V-1 5U4G
V-2 6AQ5
V-3 6AQ5
V-4 6AQ5
V-5 12AU7
V-6 6AG5
V-7 0B2

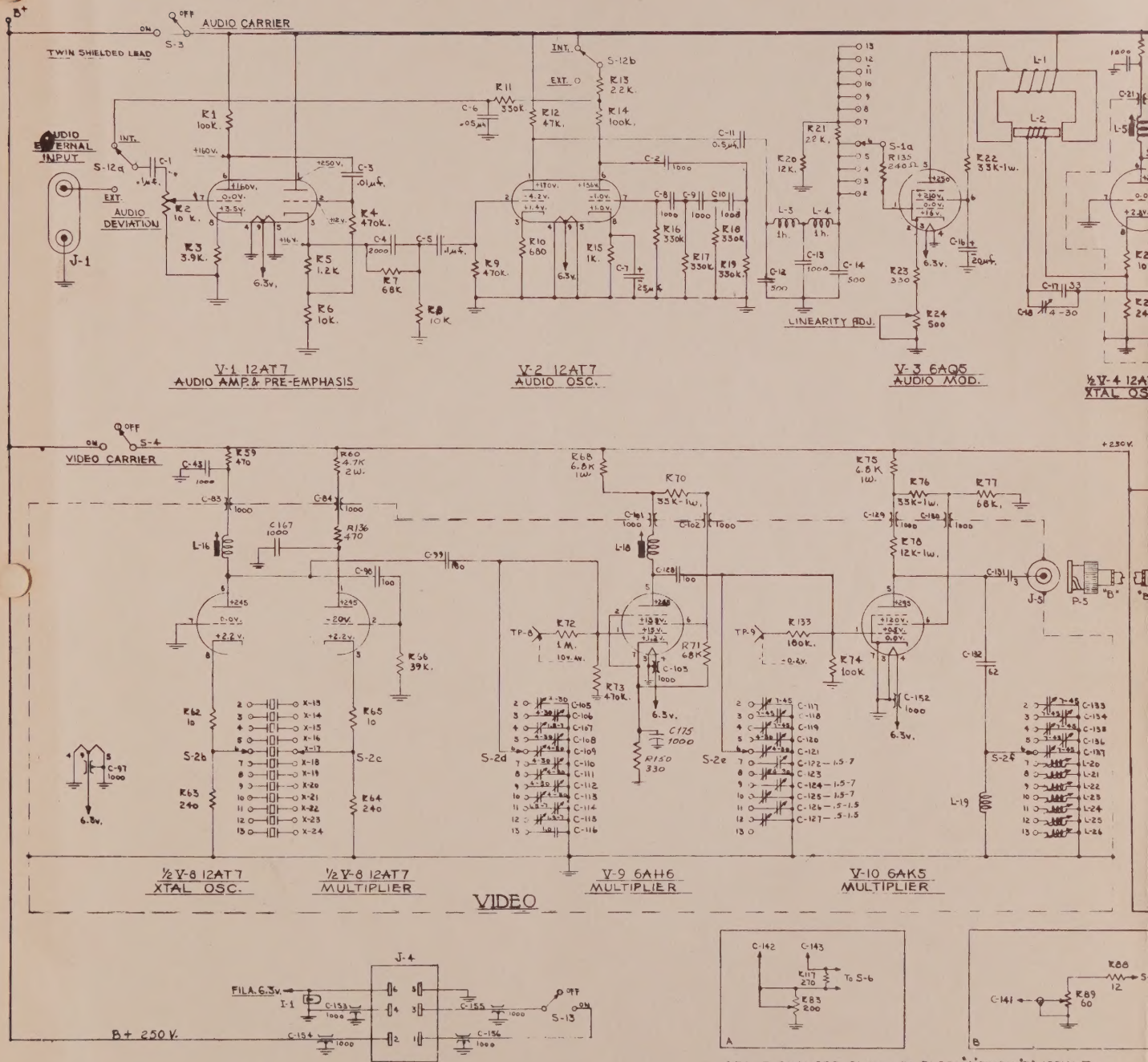
RESISTORS (ALL RESISTORS ½ WATT UNLESS OTHERWISE SPECIFIED).

R-1 330K; 1 WATT
R-2 100 OHMS; 1 WATT
R-3 33 OHMS; 1 WATT
R-4 100 OHMS; 1 WATT
R-5 100 OHMS; 1 WATT
R-6 33 OHMS; 1 WATT
R-7 100 OHMS; 1 WATT
R-8 100 OHMS; 1 WATT
R-9 33 OHMS; 1 WATT
R-10 100 OHMS; 1 WATT
R-11 150K; 1 WATT
R-12 270K
R-13 6.8K; 1 WATT
R-14 12K; 2 WATTS
R-15 100K; VOLTAGE REGULATOR POT.
R-16 330K; 1 WATT
R-17 ~~91K~~

MISCELLANEOUS

F-1 FUSE; 3A
I-1 DIODE; NE2
I-2 DIODE; NE2
J-1 JONES PLUG; S-308-AB; POWER
L-1 CHOKE; 8.5 HENRY (STANCOR C-1721)
P-1 PLUG; 110 VAC
T-1 HV-TRANSFORMER; KA-2520

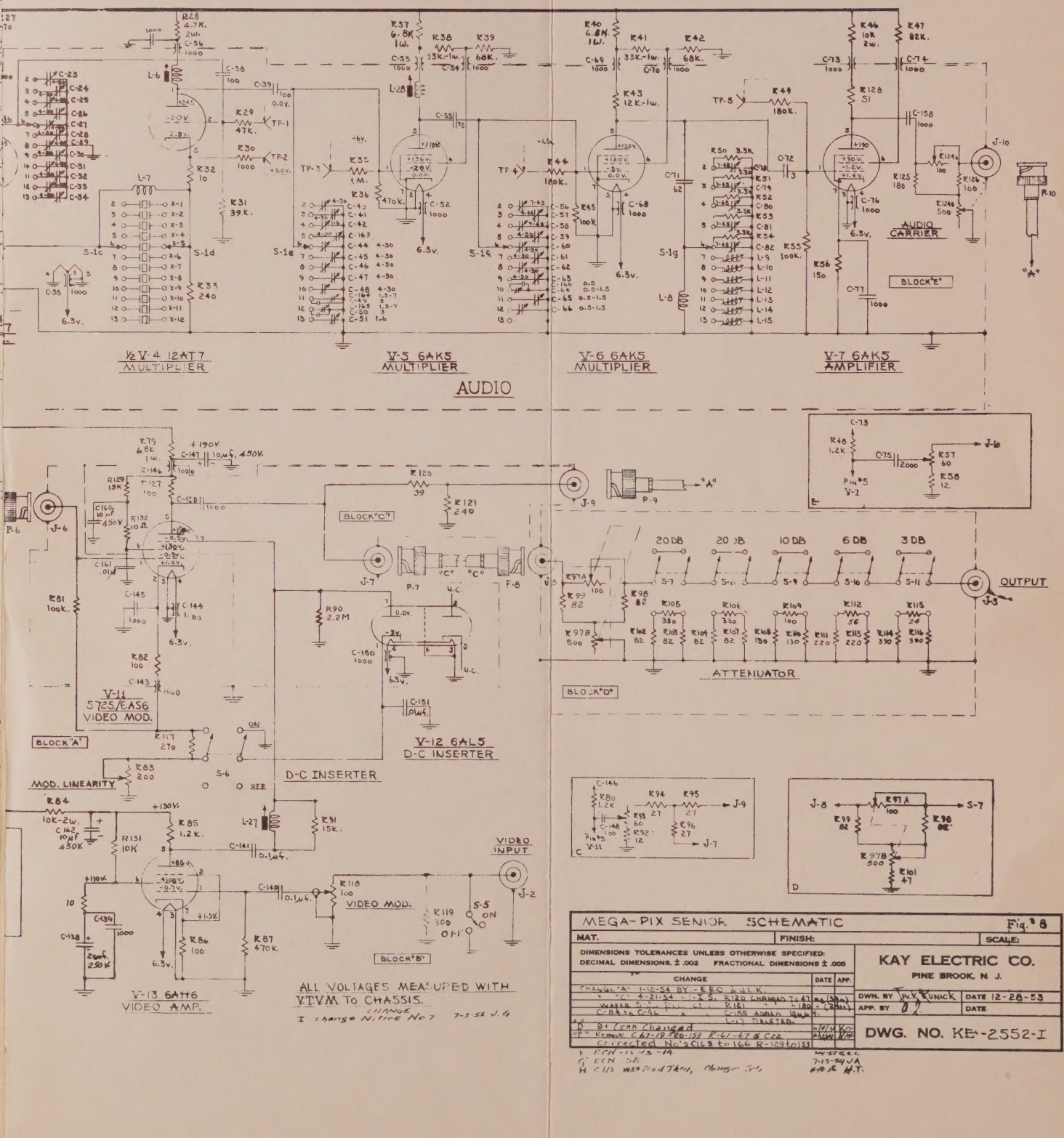
3/25/57



CIRCUIT CHANGES SHOWN IN BLOCK 'A' THRU 'E' APPLY TO EARLIER MODEL INSTRUMENTS.

Note:-

ALL RESISTOR VALUES ARE IN OHMS, K=1000 M=1,000,000 - ½ WATT SIZES UNLESS OTHERWISE SPECIFIED.
" CAPACITOR " " " MICROMICROFARADS.



MEGA-PIX SENIOR SCHEMATIC Fig. 8

MAT. FINISH: SCALE:

DIMENSIONS TOLERANCES UNLESS OTHERWISE SPECIFIED:
DECIMAL DIMENSIONS. ± .002 FRACTIONAL DIMENSIONS ± .005

KAY ELECTRIC CO.
PINE BROOK, N. J.

CHANGE	DATE	APP.
CHANGE "A" 1-12-54 BY - EEC & W.L.K.		
" " " 4-21-54 " " " " "		
WAFER S-1 " " " R121 " " R180 " (2 PLACES)		
C-84 to C-96 " " " C-158 ADDED (BLANK)		
" " " " " L-17 DELETED		
B 81 from Changead	6/7/54	K.K.
Revise C67-19 80-52 R-61-67 & C68	7/24/54	K.K.
Corrected No's C163 to 166 R-129 to 133	7/29/54	K.K.

DWN. BY K.K. KUNICK DATE 12-28-53
APP. BY DATE

DWG. NO. KE-2552-I

F ECN-11-13-19
G ECN 58
H C113 was Fixed TAPH, Change to W.E. 7-13-54 VA 6AU6 H.T.